



MACULAR THICKNESS EVALUATION FOLLOWING UNCOMPLICATED PHACOEMULSIFICATION CATARACT SURGERY USING OPTICAL COHERENCE TOMOGRAPHY

Dr Satyavani Papineni	Associate Professor Of Ophthalmology, Government Medical College, Mahaboobnagar, Telangana.
Dr Superna Mahendra	Assistant Professor Of Ophthalmology, Osmania Medical College, Hyderabad, Telangana.
Dr Atul Gupta*	Associate Professor Of Ophthalmology, Government Medical College, Nizamabad, Telangana.*Corresponding Author.

ABSTRACT *AIM OF THE STUDY:* To compare post operative visual outcome between two groups. Correlation between HbA1c, CFT in diabetic without retinopathy group. *MATERIAL AND METHODS:* 50 eyes (25 diabetic eyes without retinopathy), 25 non diabetic eyes). All Cases seen in Sarojini Devi Hospital, Hyderabad for a period of 2 years from March 2018 to February 2020. *RESULTS:* The CFT gradually increased after cataract surgery from postoperative Week (1), and had increased significantly at Week (4). When we compared the CFT between the groups, there was no statistically significant difference at 1 week, 12 weeks, but there is a statistically significant difference at post operative 4th week, results also revealed that there was no significant difference in visual outcome between the groups at any postoperative time. *CONCLUSION:* The macular thickness and the visual outcomes in Diabetic patients without retinopathy were as good as those in normal controls for up to 12 weeks after phacoemulsification cataract surgery.

KEYWORDS : Cataract Phacoemulsification; Cataract Surgery; Optical Coherence Tomography (OCT); Macular Thickness; Central Foveal Thickness (CFT)

INTRODUCTION

Cataract surgery is the most common surgical procedure world over. Phacoemulsification is an advanced surgery to remove the cataract and when Performed by a skilled surgeon causes minimal trauma to the structures of the eye with a good visual outcome⁽¹⁾.

Macular edema is a well-known complication after cataract surgery. Any intraocular surgery including cataract surgery, may induce postsurgical inflammation due to damage to the iris blood vessels and pigmented ciliary epithelium that may subsequently cause postoperative macular edema in normal individuals⁽²⁾. When the post cataract macular edema is associated with a decrease in visual acuity, it can be categorized as clinical cystoid macular edema.

Clinical cystoid macular edema (CME) is not frequently encountered after phacoemulsification with a reported incidence of 0.1 - 2% in healthy participants^(3,4). This is referred to as subclinical macular edema, with a reported incidence of 9-19% after phaco emulsification.

Diabetic retinopathy has long been implicated as a risk factor for more prominent postoperative macular edema and poorer visual outcomes. In eyes with diabetic retinopathy, the blood retina barrier is often impaired to a variable degree, which may cause the eyes to be more prone to develop postoperative macular edema. Depending on the disease severity, duration, presence of pre-existing macular edema, and previous treatment with panretinal photocoagulation or macular laser, the incidence of post phacoemulsification macular edema in diabetic retinopathy has been reported to range from 31% to 81%, which is much higher than the incidence of post phacoemulsification in nondiabetic patients⁽⁵⁾.

In the present study, we evaluated changes in CFT and visual outcomes in diabetic patients without retinopathy and in nondiabetic controls at the preoperative examination and 1 week, 4 weeks, and 12 weeks after clear-corneal phacoemulsification.

Optical coherence tomography (OCT) to measure macular thickness, has been used to assess the subclinical macular edema. To further evaluate the relationship of recent treatment to control diabetes and the degree of postoperative edema, we also compared the preoperative glycated hemoglobin (HbA1c) level and the increase in macular thickness in the diabetics without retinopathy between the two groups and within the group⁽⁶⁾.

AIM OF THE STUDY

- 1) To compare the macular thickness changes using OCT in diabetic patients without retinopathy and nondiabetic patients following uncomplicated phacoemulsification cataract surgery
- 2) To compare post operative CFT changes (1st week, 4th week, 12th

Week) between the two groups and within the group.

- 3) To compare post operative visual outcome between two groups. Correlation between HbA1c, CFT in diabetic without retinopathy group.

MATERIAL & METHODS

Study Population: Patients diagnosed with NS grade 1 to 3 with or without PSCO, underwent uneventful phacoemulsification and intraocular lens insertion by an experienced surgeon at Sarojini Devi Hospital, Hyderabad, Hyderabad over a period of 2 years.

INCLUSION CRITERIA: Cases diagnosed with Nuclear sclerosis upto grade 3 with or without PSCO, who (1).had uneventful surgery, (2).followed the scheduled postoperative examinations (1,4,&12 weeks)

EXCLUSION CRITERIA- patients who:

1. Patients having diabetic retinopathy, history of uveitis, preoperative macular edema, previous intraocular surgery and other Retinal pathology diagnosed by medical/ocular history or preoperative examinations such as dilated fundus examination, OCT, and/or fluorescein angiography.
2. Patients with dense nuclear sclerosis(Grade4)
3. patients with intraoperative complications(PCR, zonular dehiscence)

All patients were subjected to ocular examinations including tonometry, slit-lamp examinations of the anterior segment, and dilated fundus examination.

OCT was performed during each visit using a Zeiss Stratus OCT, version 4.0.

OCT works with the principle of laser interferometry. Light passing through the eye is reflected by the structures of the different retinal layers

On Z axis, 1024 points are captured over a 2mm depth to create a tissue density profile, with resolution of 10 μ. On X-Y axis, tissue density profile is repeated up to 512 times every 5-60 μ to generate a cross sectional image. Several data points over 2 mm of depth are integrated by the interferometer to construct a tomogram of retinal structures. Image thus produced resembles a histology section

The OCT scan of retina allows cross sectional study of the macular, peripapillary region including RNFL, and ONH region.

Colour Coding in OCT Scan: Red-yellow colours represent areas of maximal CRT was obtained using six diagonal, 6-mm radial line scans

,with the manufacturer's macular thickness map software (version 4.0). The mean retinal thickness of the central 1-mm-diameter area was recorded for analysis. OCT measurements were performed preoperatively, and then 1 week, 4 weeks, and 12 weeks after the surgery

Surgical procedure

All of the eyes included in this study underwent uncomplicated phacoemulsification cataract extraction surgery by one experienced surgeon. All patients signed an informed consent for undergoing the operation. The operation was done under topical anesthesia and topical povidone iodine disinfection. A clear cornea small-incision, capsulorhexis, phacoemulsification, and implantation of a foldable acrylic posterior chamber intraocular lens was performed. Postoperatively, topical prednisolone 1.0% and antibiotics were prescribed.

RESULTS

Twenty five eyes of diabetic patients and 25 eyes of control patients (non diabetic eyes) that fulfilled the inclusion and exclusion criteria were enrolled in this study. The average age of the patients was 52 years in diabetic patients, 54 years in nondiabetic patients. There were no differences in age, sex, laterality, initial BCVA, and baseline CFT between the groups.

DEMOGRAPHIC DATA

	Non Diabetics	Diabetic without Retinopathy	P Value
Number of patients	25	25	
Age	54.2 ± 12.01	52 ± 9.25	0.47
Preop BCVA (logMAR)	1.26 ± 0.31	1.35 ± 0.30	0.34
Preop CFT (um)	227.4 ± 18.8	237.4 ± 19.7	0.0725

Comparison of preoperative and postoperative central foveal thickness (mm) between the control and diabetic groups

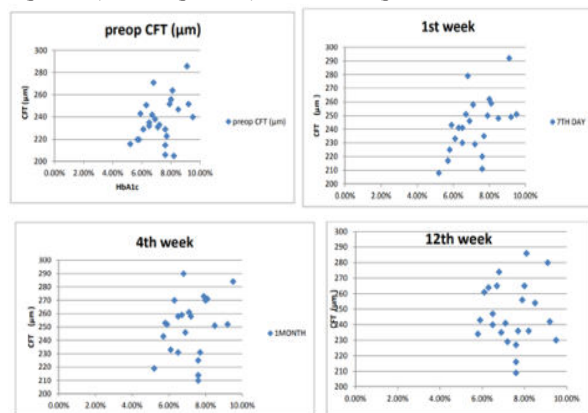
	Non Diabetics (n=25)	Diabetic without Retinopathy (n=25)	P Value
Preoperative	227.44 ± 18.89	237.44 ± 19.74	0.07
Postoperative Week 1	229.52 ± 18.64	238.84 ± 23.27	0.12
Post op 4 th Week	236.6 ± 16.93	256.88 ± 32.62	0.008
Post op 12 th week	236.96 ± 19.90	245.4 ± 19.81	0.13

Data presented as mean ± SD

Correlation between HbA1c and CRT and visual outcome in the diabetic without retinopathy group

There was no statistically significant correlation between CFT and HbA1c preoperatively (p 0.49), at Week 1 (p ¼ 0.72), Week 2(p ¼ 0.15), and Week 4 (p ¼ 0.54).

In addition, there was no statistically significant correlation between BCVA in logMAR and HbA1c preoperatively (p ¼ 0.58), and at Week 1 (p ¼ 0.39), Week 4(p ¼ 0.94), and Week 12 (p ¼ 0.91

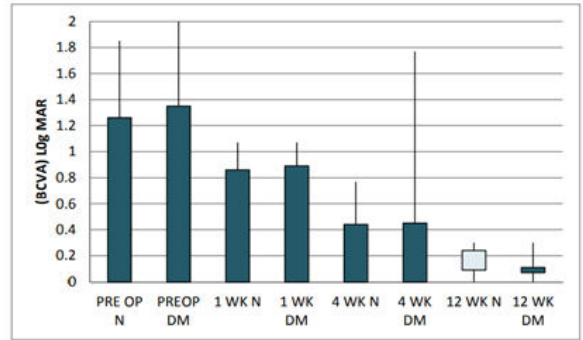


Linear regression showed no statistically significant correlation between central foveal thickness (CFT) and glycated hemoglobin (HbA1c) preoperatively (p value 0.49), at Week 1 (p=0.72), Week 2 (p =0.15), and Week 4 (p=0.54).

Postoperative visual outcomes

To compare the visual outcomes between the groups, the BCVA in logMAR was used. As expected, there were significant improvement

in BCVA at all postoperative examination time periods. However, there was no significant difference in median BCVA between the groups preoperatively (p 0.34) and at postoperative Week 1 (p 0.36), Week 4 (p 0.90), and Week 12 (p 0.58).



Comparison of preoperative and postoperative BCVA in LogMAR between the control and diabetic groups

	Non Diabetics group(n=25)	Diabetic group (n=25)	P Value
Preoperative	1.26 ± 0.31	1.35 ± 0.30	0.34
Post op 1 st Week	0.86 ± 0.22	0.89 ± 0.15	0.36
Post op 4 th Week	0.44 ± 0.24	0.45 ± 0.35	0.90
Post op 12 th week	0.09 ± 0.09	0.11 ± 0.07	0.58

Data presented as mean ± SD

DISCUSSION

In the present study, we evaluated changes in CFT and visual outcomes in diabetic patients without retinopathy and in nondiabetic controls. The results revealed that an increase in CFT was found within 4 weeks postoperatively in both groups

In both groups, the CFT gradually increased after cataract surgery from postoperative Week 1, and had increased significantly at Week 4. However, the visual acuity did not deteriorate as the CFT increased at any postoperative time point.

When we compared the CFT between the groups, there was no statistically significant difference at 1 week, 12 weeks. But there is a statistically significant difference at post operative 4th week, results also revealed that there was no significant difference in visual outcome between the groups at any postoperative time point up to 4 weeks, which also suggests that diabetes per se without diabetic retinopathy did not seem to significantly influence the visual outcomes in the short term postoperative period.

We also evaluated the relationship between HbA1c in postoperative OCT change and visual outcomes in the diabetic without retinopathy group.

In the current study, the HbA1c level was not found to be correlated with the postoperative macular thickness and visual outcome at any postoperative examination time point up to 4 weeks. Many authors have reported guarded visual outcomes after cataract surgery in patients with diabetic retinopathy, particular in those patients with pre-existing diabetic macular edema or a long history of retinopathy^(7,8,9).

Recently, Eriksson et al conducted a study using fluorescein angiography (FA) and OCT to compare postoperative macular edema and visual outcomes for 6 months between eyes with mild to moderate diabetic retinopathy and normal individuals after Phacoemulsification and foldable posterior chamber intraocular lens insertion, and found a significant improvement in both groups after cataract surgery⁽¹⁰⁾.

Hayashi et al reported a substantially increased mean foveal thickness as detected by OCT at 3months post operatively in diabetic eyes with retinopathy compared to diabetic eyes without retinopathy (23% vs.6%, respectively)⁽¹¹⁾.

Kim et al reported that both postoperative macular edema and visual outcomes were significantly worse in the diabetic retinopathy group than in the nondiabetic retinopathy group after cataract surgery. Similar to our study, they found that mean central foveal thickness of diabetic eyes without retinopathy increased by only a very small amount in the short-term postoperative periods (18 mm and 14 mm at 1

month and 3 months after phacoemulsification, respectively), whereas the mean central foveal thickness in eyes with mild to moderate nonproliferative diabetic retinopathy increased by a far greater amount at the same time periods (127 mm and 117 mm at 1 month and 3 months, respectively)⁽¹²⁾.

The more prominent increase in macular thickness was also associated with a lesser improvement in postoperative visual outcomes in diabetic retinopathy eyes.

These studies suggest that diabetic eyes with or without retinopathy respond very differently in postoperative structure and visual function after cataract surgery. Preoperative identification of whether or not the patients have diabetic retinopathy is thus an important prognostic factor in the evaluation of the expected effects of cataract surgery.

Degenring et al conducted a study similar to ours, and compared the post phacoemulsification macular changes and visual outcomes between diabetic and nondiabetic eyes for 4 weeks after cataract surgery. Although they did not find a significant difference in macular thickness on OCT between the groups preoperatively and all time points postoperatively, they did find a trend toward a more prominent increase in foveal thickness in the diabetic eyes than the nondiabetic eyes at postoperative Week 4 ($p=0.058$). However, unlike our study, they found significant worse visual outcomes at the postoperative Week 4 examination in the diabetic group than in the nondiabetic group ($p = 0.001$). This discrepancy in visual outcome may be due to the differences in the criteria for patient selection⁽¹³⁾.

Very few studies have focused on comparisons of the outcomes of post cataract surgery between diabetic eyes without retinopathy and nondiabetic eyes as in our study. Menchini et al⁽¹⁴⁾ conducted a study in 1993 comparing the incidence of CME after extracapsular cataract extraction and intraocular lens implantation in diabetic patients without retinopathy and nondiabetic patients. They found a similar frequency of angiographic CME in the two groups 30 days after surgery, but a significantly higher frequency in the diabetic eyes at 90 days, 180 days, and 360 days. Final visual acuity, however, was similar in both groups.

CONCLUSION

In conclusion, the macular thickness and the visual outcomes in Diabetic patients without retinopathy were as good as those in normal controls for up to 12 weeks after phaco-emulsification cataract surgery. The visual outcomes and CRT changes in the diabetic without retinopathy patients were also not related to the level of preoperative HbA1c during this period.

REFERENCES

1. Ursell PG, Spalton DJ, Whitcup SM, Nussenblatt RB. Cystoid macular edema after phacoemulsification: relationship to blood-*aqueous barrier damage and visual acuity. J Cataract Refract Surg.* 1999;25:1492e1497.
2. Menten J, Erakgun T, Afrashi F, Kerci G. Incidence of cystoid macular edema after uncomplicated phacoemulsification. *Ophthalmologica.* 2003;217:408e412.
3. Rossetti L, Autelitano A. Cystoid macular edema following cataract surgery. *Curr Opin Ophthalmol.* 2000;11:65e72.
4. Ray S, D'Amico DJ. Pseudophakic cystoid macular edema. *Semin Ophthalmol.* 2002;17:167e180.
5. Flach AJ. The incidence, pathogenesis and treatment of cystoid macular edema following cataract surgery. *Trans Am Ophthalmol Soc.* 1998;96:557e634.
6. Irvine SR. A newly defined vitreous syndrome following cataract surgery. *Am J Ophthalmol.* 1953;36:599e619.
7. Gass JD, Norton EW. Cystoid macular edema and papilledema following cataract extraction. A fluorescein fundoscopic and angiographic study. *Arch Ophthalmol.* 1966;76:646e661.
8. Pollack A, Leiba H, Bukelman A, Oliver M. Cystoid macular oedema following cataract extraction in patients with diabetes. *Br J Ophthalmol.* 1992;76:221e224.
9. Dowler JG, Sehmi KS, Hykin PG, Hamilton AM. The natural history of macular edema after cataract surgery in diabetes. *Ophthalmology.* 1999;106:663e668.
10. Krepler K, Biowski R, Schrey S, Jandrasits K, Wedrich A. Cataract surgery in patients with diabetic retinopathy: visual outcome, progression of diabetic retinopathy, and incidence of diabetic macular oedema. *Graefes Arch Clin Exp Ophthalmol.* 2002;240:735e738.
11. Schatz H, Atienza D, McDonald HR, Johnson RN. Severe diabetic retinopathy after cataract surgery. *Am J Ophthalmol.* 1994;117:314e321.
12. Cheng H, Franklin SL. Treatment of cataract in diabetics with and without retinopathy. *Eye (Lond).* 1988;2:607e614.
13. Dowler JG, Hykin PG, Lightman SL, Hamilton AM. Visual acuity following extracapsular cataract extraction in diabetes: a meta-analysis. *Eye (Lond).* 1995;9:313e317.
14. Horozoglu F, Yanyali A, Aytug B, Nohutcu AF, Keskinbora KH. Macular thickness.